

The Rejections

Claims 1-16 and 18-22 are rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 6,127,454 to Wada et al. Wada et al. is cited for disclosing water-absorbent resins that are surface-crosslinked with a polyol.

Wada et al. only discloses adding a crosslinking agent to resin particles in order to surface-crosslink the particles. It would not have been obvious to add a tetra- or more functional polyol to the previously surface-crosslinked water-absorbent resin in view of Wada et al.

Wada et al. does not disclose or suggest a particulate water-absorbent resin composition comprising 1) a surface-crosslinked water-absorbent resin having a particle size in the range of 850 to 150 μm , but not including 850 μm , and 2) a tetra- or more functional polyol at least on the surfaces of the particles. The Action appears to suggest that Wada et al. inherently discloses a surface-crosslinked water-absorbent resin falling within the claimed particle size range. Applicants respectfully disagree.

The particle size of the water-absorbent resin particles as disclosed in Wada et al. refers to the water-absorbent resin particles before being surface-crosslinked. The Action suggests that there is no evidence of record to support the position that the particle size of the resulting water-absorbent resin of Wada et al. after surface-crosslinking is any different from the particle size prior to surface crosslinking. One of ordinary skill in the art would readily recognize that the surface crosslinking step of Wada et al. has an effect on the particle size of the water-absorbent resin particles and that the particle size of the particles before surface-crosslinking does not correspond to the particle size after surface crosslinking.

One skilled in the art would recognize that the crosslinking agents such as those disclosed in Wada et al. are very viscous and require dilution in a suitable carrier such as water. Thus, the crosslinking agent is typically diluted in water to enable the surface crosslinking agent to be applied uniformly throughout the composition of the water-absorbent resin particles and to

provide uniform surface crosslinking . The water or other solvents as carriers used to apply the surface-crosslinking agent to the water-absorbent resin particles are absorbed into the surface of the particles. The absorption of water clearly has an effect on the particle diameter.

As specifically disclosed in the Examples of Wada et al., the surface-crosslinking agent is used in combination with water. In particular, Example 1 in column 19 of Wada et al. disclose the surface-crosslinking agent comprising 0.03 parts by weight glycerol, 0.05 parts by weight of ethylene glycol diglycidyl ether, 3 parts by weight water, 5 parts by weight isopropyl alcohol, and 0.5 parts by weight of lactic acid. Thus, the amount of the crosslinking agent is very small in comparison to the amount of water and the isopropyl alcohol in the solution of the crosslinking agent. The surface-crosslinking agent of Wada et al. forms a swollen gel layer on the outer surface of the water-absorbent resin particles due to the presence of water in the surface-crosslinking agent. The Examples specifically disclose the resulting particles having a “swollen gel layer”. Thus, the swollen gel layer of the resulting particles result in a particle diameter that is different from the particle diameter of the initial water-absorbent resin particles prior to surface-crosslinking.

Furthermore, the water content of the surface-crosslinking agent and the resulting swollen gel layer results in the water-absorbent resins being very adhesive to one another to form agglomerates that have a large particle size greater than 600 μm . Accordingly, the resulting agglomerates of the surface-crosslinked water-absorbent resins have to be pulverized to provide the desired particle size. However, when the agglomerates are pulverized, fine particles are generated resulting in an average particle diameter that is outside the claimed range.

The characteristics of the resulting surface-crosslinked water-absorbent resin of Wada et al. is demonstrated by U.S. Patent No. 6,458,921 to Dairoku et al. in columns 37-38. In the granulation Example 1 beginning in column 37, mixing the water-absorbent resin powder

with water results in a gelatinous water-absorbent resin granule having a particle diameter of 3 to 10 mm. Thus, one of ordinary skill in the art would readily recognize that the addition of the surface-crosslinking agent of Wada et al. would result in agglomeration and a change in the particle size of the resulting water-absorbent resin. Therefore, Applicants submit that the particle size of the resulting surface-crosslinked water-absorbent resin of Wada et al. does not correspond to the particle size of the water-absorbent resin particles before surface-crosslinking as suggested in the Action.

In contrast to Wada et al., the particle size of the surface-crosslinked water-absorbent resins of the present invention has been previously controlled to fall within a specific range. In addition, the claimed invention provides the surface-crosslinked water-absorbent resins having a specified particle size in combination with a tetra- or more functional polyol. Wada et al. does not reasonably disclose or suggest to one of ordinary skill in the art the concept of controlling the particle size of the surface-crosslinked water-absorbent resins as used in combination with the tetra- or more functional polyol. Therefore, the improved properties of the resulting water-absorbent resin composition of the invention would not have been reasonably expected by one of ordinary skill in the art based on the disclosure of Wada et al.

The changes in the particle size of the water-absorbent resin of Wada et al. is apparent in view of the process disclosed by Wada et al. For example, as disclosed in column 9, beginning line 57 of Wada et al., the water-absorbent resin particles are mixed with a surface-crosslinking agent in a mixer. When the water-absorbent resin particles are mixed with a surface-crosslinking agent using a mixer, a part of the water-absorbent resin particles are crushed into fine powders by contact with the impeller of the mixer. Therefore, the surface treatment of the water-absorbent resin particles results in the water-absorbent resin particles being crushed at the same time as granulation. The particle diameter of the water-absorbent resin particles before the surface treatment would not inherently be maintained after the

surface-crosslinking step of Wada et al. The effects of the changes in the particle diameter are also apparent by comparing Example 1 with Comparative Example 8 of the present specification.

The Examples in the specification demonstrate the unexpected and improved properties of the claimed water-absorbent resin composition. In particular, the Examples demonstrate the improved properties result from the surface-crosslinked water-absorbent resin particles having a particle size within the claimed range in combination with the tetra- or more functional polyol as defined in claim 1. In particular, Example 1 of the present specification demonstrates that the surface-crosslinked water-absorbent resin particles having a particle size within the claimed range and mixed with sorbitol (a tetra- or more functional polyol) provides excellent liquid permeability and liquid-sucking-up properties as shown in Table 1. In contrast, Comparative Example 1 adds a diol, namely, 1,4-butanediol and 1,2-propanediol. The properties of Comparative Example 1 are inferior in relation to the properties of Example 1. Thus, the Examples demonstrate that the tetra- or more functional polyols are important in providing the improved liquid permeability and liquid-sucking-up properties of the resulting water-absorbent resin composition when used in combination with a particulate surface-crosslinked water-absorbent resin.

Wada et al. provides no suggestion or guidance to one of ordinary skill in the art to select a tetra- or more functional polyol to be used in combination with a surface-crosslinked water-absorbent resin having a particle size within the claimed range. The broad general disclosure of surface-crosslinking agents disclosed in Wada et al. does not provide any guidance or direction to one skilled in the art to select any particulate crosslinking agent. Wada et al. suggests that each of the crosslinking agents function the same. Wada et al. provides no disclosure or teaching of the advantages or improvements of using a tetra- or more functional polyol in combination with the water-absorbent resin particles having the

claimed particle size. Thus, Wada et al. provides no expectation of success of providing improved properties of the resulting water-absorbent resin composition according to the claimed invention.

Wada et al. only discloses a water-absorbing agent for improving absorption capacity. Wada et al. does not suggest the importance of the tetra- or more functional polyol for providing excellent liquid permeability and liquid-sucking-up property when used in combination with the claimed surface-crosslinked water-absorbent resin particles. Thus, Wada et al. provides no teaching or disclosure that would lead one of ordinary skill in the art to the claimed invention.

Based on the above comments, Applicants submit that the water-absorbent resin particles of Wada et al. are not inherently the same as the claimed composition. Furthermore, based on the disclosure of Wada et al., it would not have been obvious to one of ordinary skill in the art to provide a water-absorbent resin composition having a particle size of 850 to 150 μm but not including 850 μm accounting for not less than 90% by weight of the composition and containing a tetra- or more polyfunctional polyol at least on the surfaces of the composition. Wada et al. does not disclose or suggest a surface-crosslinked water-absorbent resin having the claimed particle size and provides no suggestion of combining the composition with a tetra- or more functional polyol. Accordingly, independent claim 1 is allowable over Wada et al.

Independent claim 2 is also not obvious over Wada et al. for the reasons discussed in connection with claim 1. Wada et al. does not suggest a surface-crosslinked water-absorbent resin containing a tetra- or more functional and a tri- or more functional polycation on the surface. For the reasons discussed above, it would not have been obvious to one of ordinary skill in the art to combine a tetra- or more functional polyol with a surface-crosslinked water-

absorbent resin either alone or in combination with a tri- or more functional polycation. Accordingly, independent claim 2 is not obvious over Wada et al.

The dependent claims are also not obvious for reciting additional features of the invention that are not disclosed in Wada et al. either alone or in combination with the features of the independent claims. For example, Wada et al. does not disclose the particle size of claim 3 of a surface-crosslinked water-absorbent resin.

Wada et al. further fails to disclose a particulate water-absorbent resin composition having the liquid distribution velocity, either alone or in combination with the surface-crosslinked water-absorbent resin having a particle size of 850 to 150 μm as in independent claim 4. For the reasons discussed above, the resulting product of Wada et al. is not inherently a particulate water-absorbent resin particle having a surface-crosslinked particle with the claimed particle size so that the resulting product of Wada et al. does not inherently have the claimed liquid distribution velocity.

Wada et al. further fails to disclose a surface-crosslinked water-absorbent resin composition having the claimed particle size and having a surface OH/C ratio of 0.03 to 0.15 as in independent claim 5.

The above comments apply to independent claim 18. For the above reasons, Wada et al. does not suggest a process of producing a particulate water-absorbent resin composition where the resulting composition includes a surface-crosslinked water-absorbent resin having a particle size within the claimed range and mixing the resulting water-absorbent resin with a tetra- or more functional polyol. Accordingly, the process steps of claim 18 are also not obvious over Wada et al.

Wada et al. does not disclose or suggest the step of mixing a surface-crosslinked water-absorbent resin with a tetra- or more functional polyol. Wada et al. refers only to mixing a surface-crosslinking agent with the water-absorbent resin particles and heating to

surface-crosslink the particles. Wada et al. does not suggest the process step of mixing a surface-crosslinked water-absorbent resin particle and a tetra- or more polyfunctional polyol as in the claimed invention. Wada et al. only discloses the step of surface-crosslinking the water-absorbent resin particles. There is no teaching or suggestion to one of ordinary skill in the art in Wada et al. to obtain the surface-crosslinked water-absorbent resin, and thereafter mix a surface-crosslinked water-absorbent resin with a tetra- or more polyfunctional polyol as in the claimed invention. The addition of a polyol to the surface-crosslinked water-absorbent resin of Wada et al. would be considered unnecessary by one of ordinary skill in the art based on the disclosure of Wada et al. Thus, one of ordinary skill in the art would not have a reasonable expectation of improving the properties of the resulting composition by mixing the tetra- or more functional polyol to a surface-crosslinked water-absorbent resin based on the disclosure of Wada et al. Accordingly, Applicants submit that the process of claim 18 is not obvious over Wada et al.

Wada et al. also does not suggest a tetra- or more functional polyol at least on the surfaces of the particulate water-absorbent resin composition as in claim 6, the weight average particle diameter of claim 7, the amount of the tetra- or more functional polyol as in claim 8, the specific polyol of claim 9, the absorption capacity without load of claim 10, the absorption capacity under load of claim 11, the saline flow conductivity of claim 12, the water-absorption capacity without load of claims 13 and 14, the saline flow conductivity of claim 15, and the weight average particle diameter of claim 16, in combination with the features of claim 1. Claims 19-20 are also allowable as depending from independent claim 18. Wada et al. does not suggest the sugar alcohol of claim 19, the weight average particle diameter of claim 20, 10 to 90% of the polyol remaining unreacted in the composition as in claim 21, or obtaining the water-absorbent resin by surface-crosslinking with a surface-

crosslinking agent other than a tetra- or more functional polyol as in claim 22, in combination with the process steps of claim 18.

In view of the above comments, the claims are submitted to be allowable over Wada et al.

Claims 1-16 and 18-22 are also rejected under 35 U.S.C. § 103(a) as being obvious over JP 2002-539281 and the corresponding U.S. Patent No. 6,605,673 to Mertens et al.

Mertens et al. is similar to Wada et al. Thus, the claims are not obvious over Mertens et al. for substantially the same reasons as discussed above.

As noted in the Action, Mertens et al. does not disclose or suggest a water-absorbent resin composition having a particle size range within the claimed range. Furthermore, Mertens et al. only discloses the particle size of the gel mass after the solution polymerization and the particle size prior to the surface-crosslinking of the resulting polymer particles. For the reasons discussed above, the surface-crosslinking step results in a swollen gel layer and agglomeration of the particles. Therefore, the resulting product after the surface-crosslinking step of Mertens et al. does not correspond to the disclosed particle size prior to surface-crosslinking. Moreover, it would not have been obvious to one of ordinary skill in the art to provide a surface-crosslinked water-absorbent resin composition having the claimed particle size range as recited in claim 1.

As noted in the Action, Mertens et al. discloses surface-crosslinking of the water-absorbent resin using a surface-crosslinking agent. The crosslinking step is carried out by heating the surface-crosslinking agent and the polymer particles. The addition of a polyol to the previously surface-crosslinked polymer particles as obtained according to Mertens et al. would be considered unnecessary by one of ordinary skill in the art based on the disclosure of Mertens et al. Mertens et al. does not suggest to one of ordinary skill in the art to add a polyol to a surface-crosslinked water-absorbent resin based on the disclosure of Wada et al.

One skilled in the art would not be motivated to combine a polyol with a previously surface-crosslinked water-absorbent resin and would have no expectation of success in improving the properties of the resulting water-absorbent resin as in the claimed invention.

As previously discussed, the invention is specifically directed to the use of a tetra- or more functional polyol where at least part of the polyol is on the surface of the water-absorbent resin particles having the claimed particle size. Mertens et al. is an example of the prior compositions that can be made using various surface-crosslinking agents. The Examples in Mertens et al. provide no suggestion or guidance to one of ordinary skill in the art to use a tetra-functional polyol in the manner of the claimed invention. Mertens et al. clearly provides no suggestion to one of ordinary skill in the art to combine a tetra- functional polyol with a surface-crosslinked water-absorbent resin particle as in the claimed invention. Accordingly, independent claim 1 is not obvious over Mertens et al.

Mertens et al. also clearly fails to disclose a particulate water-absorbent resin composition comprising surface-crosslinked water-absorbent resins and a tetra- or more functional polyol in combination with a tri- or more functional polycation at least on the surfaces. As noted above, Mertens et al. only discloses a surface-crosslinked water-absorbent resin. There is no suggestion in Mertens et al. to combine the surface-crosslinked water-absorbent resin with a tetra- or more functional polyol and a tri- or more functional polycation. Accordingly, claim 2 is not obvious over Mertens et al.

Mertens et al. also does not suggest a surface-crosslinked water-absorbent resin having the particle size and the liquid distribution velocity as defined in independent claim 4. For the reasons discussed above, Mertens et al. does not inherently produce a surface-crosslinked water-absorbent resin composition having the claimed particle size. Thus, the resulting product of Mertens et al. does not inherently have the claimed properties. Accordingly, independent claim 4 is not obvious over Mertens et al.

Mertens et al. does not disclose or suggest a particulate water-absorbent resin composition having the claimed particle size and a surface OH/C ratio of 0.03 to 0.1 as in independent claim 5. For the reasons discussed above, Mertens et al. does not suggest the claimed particulate water-absorbent resin composition, and thus, does not inherently have the claimed properties. Therefore, claim 5 is not obvious over Mertens et al.

Mertens et al. clearly does not suggest a process for producing a particulate water-absorbent resin composition by mixing (1) a surface-crosslinked water-absorbent resin having the claimed particle size with (2) a tetra- or more functional polyol. As noted above, Mertens et al. only discloses crosslinking the water-absorbent resin. There is no suggestion of combining a tetra- or more functional polyol to a previously surface-crosslinked water-absorbent resin. Accordingly, the process of claim 18 is not obvious over Mertens et al.

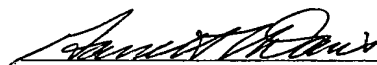
The dependent claims are also not obvious over Mertens et al. as depending from an allowable base claim and for reciting additional features of the invention. Mertens et al. does not suggest the particle size range of claim 3, in combination with the features of claim 2. Mertens et al. also does not suggest the tetra- or more functional polyol on the surface of the water-absorbent resin as in claim 6, either alone or in combination with the features of claim 4.

Mertens et al. further fails to disclose the particle size range of claim 7, the amount of the tetra- or more functional polyol of claim 8, the tetra- or more functional polyol being a sugar alcohol as in claim 9, the absorption capacity without load of claim 10, the water-absorption capacity under load of claim 11, the saline flow conductivity of claim 12, the ratio of the water-absorption capacity without load and the liquid-sucking-up rate of claim 13, the ratio of the water-absorption capacity under load and the liquid-sucking-up rate of claim 14, the ratio of the saline flow conductivity and liquid-sucking-up rate of claim 15, the weight average particle diameter of claim 16, in combination with the features of claim 1.

Mertens et al. also does not disclose the step of adding a tetra- or more functional polyol where the polyol is a sugar alcohol as in claim 19, the particle size range of claim 20, the step of heating the composition so that 10 to 90% of the tetra- or more functional polyol remain unreacted as in claim 21, or the step of crosslinking the polymerization reaction product with a surface-crosslinking agent other than a tetra- or more functional polyol as in claim 22, in combination with the process steps of claim 18.

For the reasons discussed above, the claims are not obvious over Wada et al. or Mertens et al. Accordingly, reconsideration and allowance are requested.

Respectfully submitted,


Garrett V. Davis
Reg. No. 32,023

Roylance, Abrams, Berdo & Goodman, L.L.P.
1300 19th Street, N.W., Suite 600
Washington, D.C. 20036
(202) 659-9076

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